Research on the influence of tax incentives on the quality of enterprise innovation

Lingyun Song, Shiyun Hu

Guangxi Normal University, Guilin, China

Abstract: The influence of government industrial policy on the quality of enterprise innovation has always been a hot issue in the field of industrial economy. This paper takes the government tax incentives as the starting point, and selects the data of 2,495 listed Chinese A-share companies in 2014-2020 as the sample to empirically investigate the impact of the government tax incentives on the quality of enterprise innovation. The empirical results show that the tax incentives have significantly improved the quality of enterprise innovation. This study provides some experience basis for the government to promote the improvement of enterprise innovation quality through preferential tax policies.

Keywords: A listed company; Tax incentives; Innovation quality

1. Introduction

Since the late 1980s, China began to implement industrial policy. With the progress of The Times and the development of economy, after the 21st century, China's industrial policy has strengthened the intervention of various economic activities. Of course, various industrial policies at all levels of government also allowed the economy to grow rapidly. In 2009, the key industry adjustment and ten revitalization plans and their implementation rules were issued to adjust China's industrial structure imbalance and curb overcapacity, which also allowed China to maintain a 9.2% economic growth rate under the global economic turmoil. However, this policy also has a relatively big loophole: due to the economic activities carried out by enterprises under the leadership or assistance of the government, such as the heavy industry such as steel, these industries rely on the government to reduce their ability to innovate, transform and upgrade, and their production efficiency will also decline. Many measures in industrial policy, such as guiding enterprise mergers and reorganizations, promoting transformation and upgrading, optimizing resource allocation, etc., are important driving forces to improve enterprise production capacity and accelerate industry development. After entering a new stage of high-quality economic development, China cannot only pursue the speed of development, but pay more attention to the quality of development, facilitate structural adjustment, and comprehensively deepen economic structural reform. As an important catalyst, industrial policy should make timely adjustments to help industrial transformation and upgrading and continuously obtain greater benefits.

In the face of the current situation, mass innovation is the key. Many studies have shown that innovation has become one of the most important factors for the sustainable growth of China's economy, and there are many measures of innovation. Patents are one of the important standards that reflect a country's innovative activities at the micro and macro levels. The improvement of high-quality patents plays a non-negligible role in the high-quality development of a country's economy and the improvement of its independent innovation ability. Therefore, how to improve the quantity and quality of enterprises' innovative ability through the incentive policies of the government has become a close concern of economists and governments around the world. China has been encouraging and supporting independent innovation of enterprises, after more than ten years of efforts, by 2012, China has become a world power in the number of patent applications and invention patents. However, at present, China's high-tech enterprises and related R & D personnel density is relatively low, at the same time there are many "cheating innovation" and "strategic innovation" behavior, enterprise innovation is facing the dilemma of focusing on quantity, light quality, to promote the improvement of enterprise innovation quality has become the focus of the current government incentive policy. Therefore, from the perspective of micro-enterprises, it is of great practical significance to study the specific effects of the implementation of government incentive policies, guide the improvement of enterprise innovation quality, promote enterprise transformation and upgrading, and promote sustained high-quality and orderly economic development. Tang Yingkai et al.[2]

Of course, the impression of different industrial policies on enterprise innovation has always been the focus of scholars at home and abroad, but in some existing studies, the effect of government incentive policies on innovation has not yet reached a unified conclusion. On the positive side, Bai Xuyun et al.[1], Zhou Yan et al.[2]starting from tax incentive policies, believe that the leading role of government in tax revenue is not obvious, but more dependent on the performance of enterprises led by the market, which can better stimulate the improvement of innovation quality of enterprises. Yang Bo and Wang Linhui[3]compared the impact of the accelerated depreciation policy of fixed assets and government innovation subsidy policy on the quality of enterprise innovation, and argued that government innovation subsidy is more conducive to increasing high-quality innovation output. By studying the impact of industrial policies on enterprise innovation, Yu Minggui [4] and others believe that compared with the generally encouraged industries, both government subsidies and tax incentives can positively promote technological innovation in key encouraged industries. Cao Hongjian and other[5] started from the innovation fund and found that the innovation policies have a significant incentive effect on the innovation quality of small and medium-sized enterprises.

However, some scholars put forward the opposite opinion, Zhang Jie and other [6] believe that the government's intervention to a certain extent will inhibit the quality of the enterprise's export products, and the external effect of market competition can stimulate the improvement of product quality; When the external policy incentive effect is more obvious in the short term, Deng Xiangrong and Feng Xueliang [7] found that the improvement of the quality of enterprise innovation will be inhibitory; After comparing state-owned and private enterprises, Bai junhong[8] concluded that the more the government invests in state-owned enterprises, the fewer patents it will produce. However, the current dual failure of government and market leads to enterprises' enthusiasm for social capital investment rather than technology research and development investment, which is the distortion of enterprise investment behavior caused by government subsidies[9] .

The above related government practice measures and literature reviews deviate from the realistic expectations, which provides a lot of thinking and inspiring experience and evidence for the study of the effectiveness of government subsidies and tax incentives in China, and even in-depth exploration of their mechanism of action.

This paper uses the data of China's A-share listed enterprises from 2014 to 2020 to study the effect of preferential tax policies on enterprise innovation quality. The second part is theoretical analysis and research hypothesis, the third part is variable description and model setting, the fourth part is empirical analysis, and the fifth part is conclusion and policy enlightenment.

2. Theoretical analysis and research hypothesis

Preferential tax policy refers to a special expenditure of our country's government through adopting a new tax system completely opposite to the existing basic forms of taxes, giving taxpayers a tax welfare measure of policy nature, so as to lighten the burden of taxpayers, so as to achieve the purpose of realizing or helping standardize the business behavior of taxpayers and their enterprises, and to support and encourage the economic development of individuals and local enterprises. Through observation and access to information, we can understand the preferential tax policies in China's current tax law, most of which are mainly aimed at promoting the construction of a harmonious socialist society and promoting the construction of an environment-friendly and resource-saving society. All preferential tax policies can be summarized into direct and indirect preferential implementation forms. For example, in strategic emerging industries, the main purpose of preferential tax policies is to promote scientific and technological innovation and expand investment, alleviate the financing difficulties of some enterprises, so as to enhance the increase of corporate profitability and promote sustainable health development. At the same time, the preferential tax policy as a means of reward after the event, its independence is relatively higher. Since it must be operated by the company itself to achieve the purpose of enterprise reduction and exemption, preferential tax policies can serve as the expected return of the company, so the rent-seeking problem generated by such measures is relatively small. Therefore, more scholars advocate the use of preferential tax policies to reduce the competitive externalities of enterprises.

The production of high-quality innovative products such as invention patents usually requires a stronger material foundation, but also requires a strong basic ability of the research and development team and open-minded leaders and other conditions. On the one hand, the preferential tax policy, as a post-incentive method, is more controllable for enterprises. Enterprises can also obtain a fixed tax to return this capital source through continuous innovation and research and development activities and

innovative performance. The preferential tax policy also provides timely research and development fund support for enterprises, and injects research and development motivation and investment into enterprises. The two complement each other and promote each other. In this mutual relationship, the key factor to maintain a virtuous cycle of business is high efficiency production. But on the other hand, compared with other government policy measures, the leading role of the government in the preferential tax policy is not prominent. Because the high-tech innovation results spontaneously generated by enterprises under the socialist market mechanism are the key factors for enterprises to get tax rebates, enterprises have full spontaneous enthusiasm and focus on improving the performance created by production. Precisely because such high-quality output results are the main driving force for enterprises to get tax incentives from the government. From this process, we can find the necessity of efficient production, which also shows that if enterprises only pay attention to the scale and ignore the quality of production, they will not be able to use the means of government incentives to obtain the effect of tax relief, so the tax incentive policy has a more obvious role in promoting the production of high-quality enterprises rather than low-quality enterprises. Therefore, the following hypothesis is given:

H1: The more tax incentives a company receives, the higher the level of innovation quality of the company.

3. Variable description and model setting

3.1. Model setting

In order to discuss the influence of tax incentives on the innovation quality of enterprises, and test the assumptions proposed in this paper, the paper constructs the following measurement model:

$$\mathrm{Fre}_{it} = \alpha + \beta \mathrm{tax}_{it} + \gamma X + \theta_i + \mu_t + \varepsilon_{it} \tag{1}$$

Variables such as the size, Assets and Capital intensity of the sample enterprises are controlled, and logarithms of some variables are taken into the model. In formula (1), Fre_{it} is the innovation quality of enterprise i in year t, tax_{it} is the tax incentives enjoyed by enterprise i in year t, β is the parameter estimate of tax incentives, X and γ are the selected control variables and their parameter estimates, meanwhile, the Industry fixed effect and Time fixed effect are also added to the model, and ε_{it} is the random error term.

3.2. Index and variable selection

3.2.1. Explained variables

The explained variable is the frequency of innovation quality of the company. In the study by Yang Tingting et al [10], it is shown that many previous articles on the patent of listed companies only consider the listed company's home, while ignoring its holding subsidiary, which leads to the mismatch between the data in the study and other financial data. Therefore, the selected data in this paper are collected and aggregated to the listed companies as far as possible.

3.2.2. Explanatory variables

The explanatory variable is tax incentives Taxp, which is expressed as the sum of the various tax rebates received by the enterprise in the study year divided by the total tax rebates received plus the total tax paid.

3.2.3. Control variable

Control variables include enterprise Size, which is represented by the natural logarithm of the number of employees in the current year. The total assets Scale is obtained by taking the natural logarithm of the total assets at the end of the period; Capital intensity Capint, expressed as fixed assets divided by total assets; Industry competitiveness HHI, expressed as the Herfindahl-Hirschman index of the two-digit industry based on firm revenue; The Nature of enterprises, expressed in the form of major shareholders, state-owned enterprises are 1, and private enterprises are 0.

The specific variable definitions are shown in Table 1.

Table 1: Variable definitions

Variable type			Variable description
Explained variable	Enterprise innovation quality	frequency	Patent citations
Explanatory variable	Tax incentives	Taxp	Tax refunds received /(Tax refunds received + taxes paid)
Control variable	Total assets	Scale	Take logarithm of total enterprise assets
	Enterprise scale	Size	Take the natural logarithm of the number of employees
	Capital intensity	Capint	Fixed assets/total assets
	Industry competition degree	HHI	Herfindahl-hirschman index for the two-digit industry based on corporate revenue
	Nature of enterprise	Nature	The nature of major shareholders, 1 represents state-owned, 0 represents non-state-owned

3.3. Data source

In June 2014, the Political Bureau of the CPC Central Committee reviewed and approved the Overall Plan for Deepening the Reform of the Fiscal and Taxation System, so this paper did not use the data before 2014, but used the data of China's A-share listed enterprises from 2014 to 2020 for research. The research and development data of listed companies came from the WIND database, and other data came from the Guotai 'an Financial Research database. At the beginning, we also processed the sample data as follows: ST, PT and listed companies in the financial industry were excluded, and sample companies missing important information were deleted. Finally, we got the observed values of 2495 enterprises.

4. Empirical analysis

4.1. Descriptive statistics

Table 2 shows the descriptive statistical results. The average value of enterprise patent citation is 3.540, the maximum value is 10.82, and the minimum value is 1.099. From the numerical perspective, the innovation degree of each enterprise is not high, of course, it can be seen that the innovation gap among all enterprises is very large, and the total observed value of 13053 can also be seen that there is a certain number of missing values. The minimum value of total assets is 14.94, the maximum is 28.64; The standard deviation of the number of employees is 1.278, the maximum value is 13.19, and the minimum value is 1.946. It can also be seen from these two values that the scale of enterprises varies greatly. The mean value of the nature of enterprises is 0.334, and the standard deviation is 0.471. It can also be seen that the proportion of non-state-owned enterprises in all the observed enterprises is relatively larger.

Table 2: Descriptive statistics

Variable name	N	Mean	median	Sd	Min	Max
Frequency	13053	3.540	3.497	1.635	1.099	10.82
Taxp	21532	0.144	0.0460	0.198	-0.0520	0.977
size	21530	7.651	7.561	1.278	1.946	13.19
scale	21532	22.22	22.04	1.337	14.94	28.64
Capint	21532	0.207	0.172	0.161	0	0.954
HHI	21521	0.159	0.130	0.114	0	0.810
Nature	21048	0.334	0	0.471	0	1

4.2. Baseline regression analysis

According to the econometric model in equation(1), 2014-2020 is selected as the sample period, and the regression results of the effect of tax incentives on the innovation quality of China's A-share listed enterprises are shown in Table 3. As can be seen from Table 3(1), under the premise of adding the fixed

effect of time and industry, tax incentives have a significant promoting effect on the innovation quality of enterprises, and the influence coefficient is 0.261. In order to ensure the continuity of the policy promotion effect, the data of the explained variables are regressed one stage later in Table 3(2), and the results show that the preferential tax policies still have a significant positive effect on the improvement of enterprise innovation quality. In the control variables, the scale and total assets of enterprises have a positive promoting effect. It can be seen that the larger the scale of enterprises, the higher the degree of reflection of government policies, the more dependent on government policy support. Moreover, the nature of enterprises also has a significant positive effect. It can be concluded that, compared with private enterprises, preferential tax policies have a more prominent promoting effect on state-owned enterprises. In a word, the regression results of each variable are basically consistent with the hypotheses in this paper.

Table 3: Regression results

	(1)	(2)
Variable	Frequency$_t$	Frequency$_{t+1}$
Taxp	0.261***	0.123**
	(4.36)	(2.08)
size	0.183***	0.152***
	(9.88)	(7.63)
Nature	0.345***	0.330***
	(9.05)	(8.79)
scale	0.316***	0.311***
	(16.60)	(15.15)
Capint	0.029	0.230**
	(0.31)	(2.38)
HHI	-1.161***	-1.232***
	(-9.03)	(-8.79)
Constant	-6.337***	-6.343***
	(-16.27)	(-14.68)
N	12,619	11,901
Industry	YES	YES
Year	YES	YES

Note: *, **, **** indicate that they are significant at the level of 1%, 5%, and 10%, respectively, and the T value in parentheses, the same below

4.3. Robustness test

4.3.1. Data indentation processing

Considering that there may be outliers in the sample data, we further conducted 1% tail indent processing for all control variables, and then conducted regression test. The test results showed that the hypothesis in this paper was still significant and not disturbed by outliers.

4.3.2. Consider the problem of missing variables

This paper refers to the research of Yu Minggui et al.[4], and considers other factors that influence enterprise innovation, such as asset-liability ratio Lev, the ratio of total liabilities to total assets; Variables such as corporate performance Roa and the ratio of total profits to total assets will also have an impact on corporate innovation quality. Therefore, after adding these control variables, the regression results show that tax incentives still have a positive promoting effect on the improvement of corporate innovation quality.

5. Research conclusions and policy recommendations

This paper uses the patent data of China's A-share listed companies and their consolidated subsidiaries to empirically test the effect of tax incentives on the patent quality of listed companies. The findings are as follows: First, tax incentives have a significant positive effect on the improvement of enterprise innovation quality, and its effect has a significant continuation effect, and the effect on the improvement of enterprise innovation quality will continue for a period of time; Second, the promotion effect of the

policy on state-owned and large-scale enterprises should be more obvious.

According to the conclusions of this paper, the following suggestions are given: First, compared with direct government R&D subsidies, tax preferential policies are more in line with the quantity and quality innovation needs of most enterprises. Therefore, it is necessary to strengthen the organic combination of government and market, maximize the combination of visible and invisible hands, improve the effectiveness of policies, and then improve the competitiveness of enterprises and promote economic development; Secondly, government policies should be different for different types of enterprises. Research shows that the effect of government incentive policies has certain heterogeneity. Preferential tax policies have a more significant incentive effect on state-owned enterprises and high-quality innovative enterprises, so limited reduction and reduction resources should be invested in more effective industries, which is also conducive to the development of advanced industries and high-quality development of our country. With the improvement of tax incentives, more enterprises can invest enough funds in the research and development of innovative products in the industry, and ultimately improve the quality of innovation, which is also a virtuous cycle; Finally, the government should also strengthen the performance assessment of enterprises to be encouraged. Some existing enterprises apply for patents at will to complete the performance indicators of the government, resulting in a sharp increase in the number of patent applications, but the quality of patent applications is worrying. Therefore, it is necessary to increase the quality assessment standards of relevant patents, so as to truly improve the innovation ability of enterprises.

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